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ANNUAL REPORT OF THE
PACIFIC NORTHWEST FOREST EXPERIMENT STATION
FOR THE CALENDAR YEAR 1937

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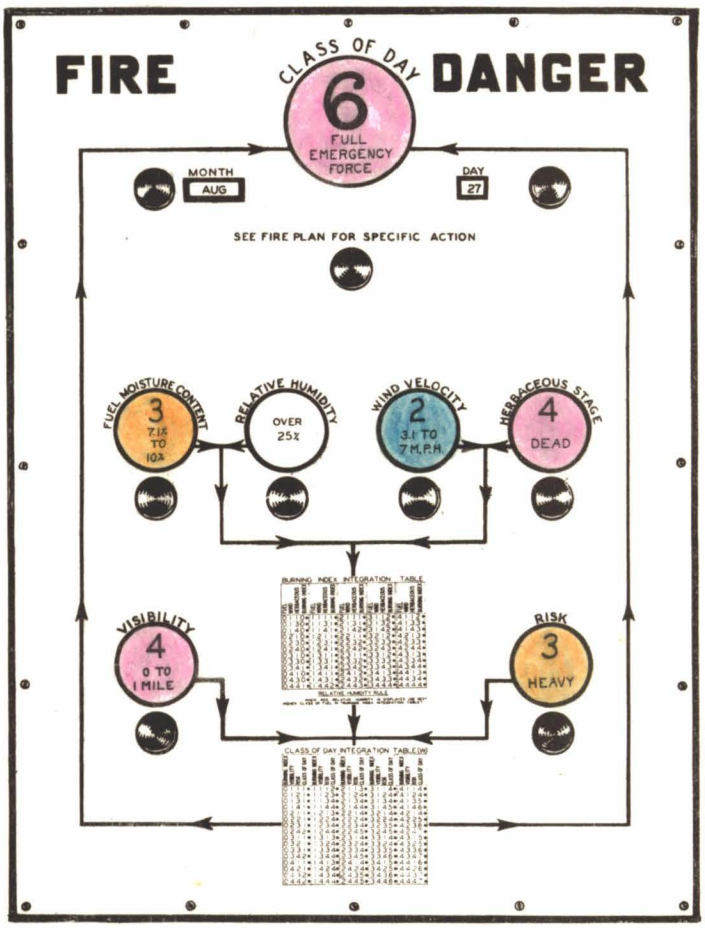

REGION SIX FIRE DANGER BOARD

PORTLAND, OREGON

FEBRUARY 2, 1938

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Reports
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United States Court House
Portland, Oregon
January 22, 1938

REPORT OF THE PACIFIC NORTHWEST FOREST EXPERIMENT STATION FOR THE CALENDAR YEAR 1937

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SIGNIFICANT ACHIEVEMENTS OF 1937

The most notable additions to the Station's program during the year were (1) participation, in cooperation with the Soil Conservation Service and the Bureau of Agricultural Economics, in a study of the land-use aspects of flood control under the Flood Control Act of 1936 and (2) intensive cooperation on the Western Range Survey of the newly created Division of Range Studies. The year has brought satisfactory progress to the several long-time projects that were continued from previous years.

The Biological Survey has assigned a forest biologist, Mr. A. W. Moore, to be affiliated with this Station for research in rodent control and other wild life problems relating to silviculture and range management.

While the year began with a large complement of temporary employees, paid from emergency or relief funds, the quotas have been severely reduced and many well-trained assistants have been dropped, delaying the completion of work under way.

The more significant activities of the year may be briefed as follows:

1. The logging of seven test plots of 60 to 100 acres each in mature ponderosa pine on the Pringle Falls Experimental Forest, and the collection of a large amount of data on the economics and silvics of different methods of cutting.

2. The Pringle Falls field meet in early October, attended by over 60 lumbermen and foresters, was a high light of this year's work for two major Station projects, namely, logging economics and pine silviculture. The meeting was sponsored by the Western Pine Association to give timber operators an opportunity to study the results of the seven variations of selective cutting on the experimental forest.

3. Addition of the Lookout Mountain Unit of 3,500 acres of immature ponderosa pine to the Pringle Falls Experimental Forest, and development work started.

4. The extension of the transportation system on all five experimental forests by the construction of about 9 miles of road and 30 miles of trail, which will help greatly in making these areas accessible for administration, protection, and demonstration.

5. Construction of headquarters buildings and other improvements on the experimental forests from emergency funds. This completes the major immediate needs on all five areas.

6. Establishment of a natural area of 1,122 acres on the Port Orford Cedar Experimental Forest.

7. Reexamination of the Tillamook Burn four years after the fire to determine the status of reproduction, and a report prepared.

8. The addition of six "poisoning" plots to the stand improvement study in defective old-growth Douglas fir-hemlock stands on the Wind River Experimental Forest, thus completing the establishment of 30 one-acre plots which aim to restore declining stands to a growing condition by cutting, girdling, and poisoning living defective trees.

9. The establishment of eight stand improvement and growth plots in the red alder type at the Cascade Head Experimental Forest, marking the beginning of a study of the silvicultural phases of management of this, our most important hardwood type in the Douglas fir region.

10. Designing, assembling, and putting into practical use over 100 fire danger boards (see front cover) on all ranger districts in R-6 and on lands of several cooperating agencies, and making a critical analysis of the season's experience.

11. Preparing the working plan for the fire control replanning project for the national forests of R-6, and supervising the necessary basic statistical studies.

12. An analysis of the local governmental organization, financial structure, and land ownership pattern of three counties in western Washington with special reference to opportunities, through governmental reorganization and disorganization, to economize and to make property taxes on forest lands more predictable.

13. Contributions in many forms, largely in cooperation with other agencies, toward a solution of land-use problems, with special reference to tax delinquency, disposition of tax-forfeited lands, valuation of forest lands for tax purposes, and rural land classification.

14. Completion of the basic office computations for the inventory phase of the forest survey of eastern Oregon and eastern Washington.

15. Publication of forest statistics for ten eastern Oregon and eastern Washington counties, completing the series of forest survey county reports for Oregon and Washington.

16. Initiation of a program to keep forest survey inventory data in the Douglas fir region up to date. Completion of inventory field work in Clatsop County, Oregon, and Grays Harbor County, Washington, represents the first step in the revision of timber type and volume data.

17. Continuation of ponderosa pine mill analyses with two studies at Bend, Oregon, to provide data on grade recovery expectancies of central Oregon timber.

18. Selection for biennial examination of 1,100 telephone poles treated with Anaconda Paste Preservative in eleven Forest Service lines.

19. Completion of field work on an intensive analysis of farm wood requirements for buildings, posts, poles, etc.

20. Analysis of the results of 40 percent maturity selection cuttings on a 10,000-acre experimental area on the Malheur National Forest, undertaken to test the conclusions of the so-called "Hines Study", which verified the prediction made in that study and convincingly demonstrated the economic and silvicultural advantages of light cutting.

21. Analysis of selective timber management of timber areas tributary to the Kinzua Pine Mills according to which important financial and silvicultural gain can be made by changing from heavy to light cutting.

22. Demonstration marking of light maturity selection on the operations of the Brooks-Scanlon Lumber Co. and the J. Neils Lumber Company, followed by mass tests of comparative lumber grade recoveries and production costs.

23. Initiation of the range studies program by an investigation of range research methods and range utilization in the Blue Mountains.

24. Cooperation on the Western Range Survey through coordination of the surveys made by various agencies and compilation of data for 5,180,000 acres of range land in Oregon and Washington, 1,319,000 acres of which were assembled into final forage type maps.

25. Holding of 17 joint hearings in cooperation with the U. S. Army Engineers, completion of the preliminary report on Lewis River, Washington, and progress on preliminary reports for three other streams in cooperation with the Soil Conservation Service and the Bureau of Agricultural Economics, all part of the program authorized by the Flood Control Act of 1936.

PERSONNEL

Mr. Munger was out of the office on account of illness for several months, during which time Mr. Andrews was in charge of the Station. Since Mr. Munger's return to duty he has chosen to devote most of his time to technical and professional work in the field of forest management rather than to executive work, and Mr. Andrews has continued as Acting Director.

The yearlong "regular" technical personnel of the Station has had a few changes during the year. With work on the Forest Survey tapering off, Mr. Paul Kemp was transferred to the Northern Rocky Mountain Station for similar work on March 1. Mr. Wade DeVries was transferred here from the California Station for studies in taxation. Junior Forester Earl G. Dunford was changed from "emergency" rolls to the "regular" rolls for flood control surveys. Mr. Elbert G. Reid came to the Division of Range Studies as a Junior Range Examiner from the Snoqualmie National Forest. Miss Jeppesen, who has been librarian on emergency funds for several years, was transferred to the regular rolls. We were sorry to lose, by resignation, two experienced, competent clerks--Mrs. Suckow and Miss Straw.

The "regular" personnel now consists of the following:

Thornton T. Munger	Director
Horace J. Andrews	Senior Forest Economist
Axel J. F. Brandstrom	Senior Forest Economist
Sinclair A. Wilson	Senior Forest Economist
Wade DeVries	Senior Forest Economist
John E. Lodewick	Senior Silviculturist
Robert W. Cowlin	Asst. Regional Director, Forest Survey
Gerald D. Pickford	Forest Ecologist
Herman M. Johnson	Associate Forester
Floyd L. Moravets	Associate Forester
Philip A. Briegleb	Associate Forester
Donald N. Matthews	Associate Silviculturist
Leo A. Isaac	Associate Silviculturist
Ernest L. Kolbe	Associate Silviculturist
William G. Morris	Assistant Silviculturist
Warren H. Bolles	Assistant Forester
Edward D. Buell	Assistant Forester
Eric A. Anderson	Junior Forester
Earl G. Dunford	Junior Forester
Elbert H. Reid	Junior Range Examiner
June H. Wertz	Junior Administrative Assistant
Christina M. McPhail	Clerk-Stenographer
Frances Elliott	Clerk-Stenographer
Inga Frisvall	Clerk
Edna L. Hunt	Assistant Clerk-Stenographer
Ruth E. Hickman	Junior Clerk-Stenographer
Evelyn L. Berg	Junior Clerk-Stenographer
Dorothy E. Rude	Junior Clerk-Stenographer
Leona M. Stevens	Junior Clerk-Stenographer
Erna Jeppesen	Under Library Assistant

20

10

33 1/3 %

Another member of the technical staff, Mr. Morris, took the three-months' winter course in statistical methods and the design of experiments at Washington, D. C. Miss Jean Kerr, editor from the Washington office, has been on detail at the Station again during the entire year. Three Junior Foresters--Harold Rapraeger, Vernon Hicks, and Victor Stevens--paid from administrative funds of the Regional Forester's office, are now working on the fire control replanning project under the direction of this Station. Mr. John C. Wilkinson is also paid in part from the Regional Forester's funds for fire studies.

With the curtailment of emergency funds it became necessary, in the course of the year, to drastically reduce the number of "temporary" (CCC) technical employees. Seven Junior Foresters under appointment were transferred to the regular rolls of Region 6 and three entered private work. It was difficult to dispense with the services of these men, who, during recent years, had become valued assistants and in some cases handled responsible technical work which now must go undone. These are Stanton G. Hayward, Roy C. Carlson, David H. Judkins, Clarence W. Richen, Charles H. Willison, Marion N. Nance, William H. Beeman, Jr., Harry M. Wolfe, Boyd L. Rasmussen, and Walter E. Pelto.

The CCC personnel consists at present of the following:

Appointed

Wickliffe V. Litchfield	Assistant Forester
William E. Sankela	Assistant Forester
George S. Meagher	Junior Forester
Arthur W. Hodgman	Junior Forester

Unappointed

Kermit Peterson	Assistant to Technician
John R. Stevenson	Assistant to Technician
Donald McKay	Assistant to Technician
Charles Herold	Assistant to Technician
Grace Fredricksen	Assistant Clerk
Bert C. Baker	Junior Clerk

Seven Junior Assistant to Technicians were employed under CCC for a portion of the year and assigned to the experimental forests. The services of three were terminated September 30; the other four were terminated December 31.

Under the Emergency Relief Appropriation the Station had an allocation of 572 man-months with an average allowance for the year of $61.43 per man per month. With this small allotment it was necessary to release practically all of the WPA office employees and concentrate efforts on improvement work at the experimental forests.

At four of the experimental forests squads of CCC boys, from three to twenty-five in number, have been used part of the year largely on construction work.

During the summer eight "student assistants" (forest school underclassmen), paid from CCC funds, were assigned at four of the experimental forests. They did good work and incidentally were given training valuable to them.

FINANCES

The regular appropriation for the fiscal year 1938 (commencing July 1, 1937) is $113,200, divided as follows: Forest Survey, $34,000; Forest Management, $26,650; Forest Products, $14,200 (a decrease of $100); Forest Economics, $13,000; Range Investigations, $11,850 (an increase of $1,950); Forest Fire Cooperation, $6,500; and Flood Control, $7,000. This is an increase of $15,350 over the preceding year's allotment, accounted for mainly by the addition to the Station's program of two new projects--Flood Control Studies and a study of Taxation financed under the Clarke-McNary law from the Forest Taxation Inquiry allotment. In addition to the above the Station was allotted $16,450 of Soil Conservation funds for the period July 1, 1937, to February 28, 1938, to carry on compilation and analysis of range survey data in Region A of the Western Range Survey project.

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A CCC allotment of $25,100 was received for the fiscal year, as compared with a total allotment of $68,000 for last year.

WPA funds in the amount of $36,050 were allotted for our various ERA relief labor projects, which is $56,290 less than was allotted the previous year.

LIBRARY

During the year 1937, 40 new books and 735 pamphlets and reprints were added to the library collection. A considerable number of these were in the field of the new division of grazing research. The following new periodical subscriptions were also added: Soil Science, Forestry Chronicle, Journal of American Society of Agronomy, Herbage Abstracts, and Herbage Reviews. The photographic collection was increased by about 640 pictures taken by staff members and a professional photographer.

Beginning this year the membership of the Library Committee is rotated among different members of the staff, a new member added and the chairman retiring each year. A permanent place as librarian has been created, now filled by the librarian who has for some time been on emergency rolls.

EXPERIMENTAL FORESTS

A tract of 3,536 acres of young, even-aged ponderosa pine, named the Lookout Mountain Unit, was added to the Pringle Falls Experimental Forest. This area, separated from the Pringle Butte Unit by about 3 miles, is especially well-suited for experiments in thinning and pruning and for studies of growth and site factors.

An area of 1,122 acres within the Port Orford Cedar Experimental Forest was set aside by the Chief of the Forest Service by executive order as a natural area.

The 1937 season saw an increasing number of visitors at the experimental forests. Pringle Falls was the meeting place for a forest-practice conference of timbermen, a silvical conference by project leaders from all western experiment stations, and for field classes by two large forestry-student groups.

Wind River continues to be the "show place" for those wishing to see a variety of forest activities in the Douglas fir region, and was again this year visited by four classes of forest school students.

Some of the principal accomplishments during the year were as follows:

At Blue Mountain Experimental Forest

A 3-car garage and storage building constructed.
Water system installed.
Septic tank and sewer system finished.
Three miles of road constructed.
Three miles of roadside cleanup done.
A log bridge over Summit Creek completed.

At Cascade Head Experimental Forest

Three miles of road rough surfaced and 2 miles top surfaced.
Three additional miles of road cleared and half graded.
Seven miles of horse trail built.
Four additional red alder stand improvement plots established.
Study to determine proper harvesting of sword fern started.
Study of distribution of precipitation under trees and in open.
Cooperation with Biological Survey in rodent control studies.
Current records kept of climate, phenology, and fire hazard.
Experimental plantations made of several desirable tree species.

At Port Orford Cedar Experimental Forest

The 5-room office and dwelling with its woodshed completed.
The 140-ft., 2-span, log stringer bridge finished.
One-quarter-mile road, to headquarters site completed.
A combination shop and 3-car garage built.
Two miles of utilization road under construction.
Approximately 2 miles of trail built.
1,360 acres 20 percent cruised and mapped.

At Pringle Falls Experimental Forest

Sixteen miles of trails constructed on new unit.
Two miles of roadside hazard reduction and firebreaks.
600 acres cruised and mapped.
Headquarters buildings all repainted and wired for lights.
Records taken at three physical-factor and one fire-hazard station.
107 permanent camera points established.
Seventeen permanent elevation benchmarks established.
Seven methods-of-cutting plots logged and remeasured.
Field tests of snag burning completed.
Numerous measurements recorded on permanent sample plots.
Improvement of recently logged plots by sale of limb wood and lodgepole pine cross ties.

At Wind River Experimental Forest

Six 1-acre plots added to Douglas fir stand improvement study.
Establishment of crop tree pruning study in young Douglas fir.
Second pruning done on two plots previously established.
Arboretum reexamined and remeasured and progress report written.
Five plots established to test planting possibilities in brush.
Two and one-half acres added to Douglas fir spacing test plantation.
Effect of forest cover on snow melting recorded and written up.
Minimum crown density for Douglas fir regeneration studied.
Laying out a proposed selective logging sale of piling.
Current records kept of climate, phenology, fire hazard, etc.
Five miles of horse trail built.
One mile of Panther Creek road graveled.
One mile of additional right-of-way road clearing done.
Eleven miles of roadside cleanup made.

DIVISION OF SILVICS

Forestation and Botanical Research

Five years ago an account of the Wind River Arboretum from its inception in 1912 to 1932 was prepared and published. In 1937 the arboretum was completely reexamined, all trees remeasured, and a second progress report was issued to make available an up-to-date inventory of this tree collection and to analyze the accumulated results from this project. During the 25-year period since establishment 497 lots of tree seeds, mostly exotics, have been tested at the arboretum. There are at present 130 different species of conifers growing in the arboretum, of which 49 are pines. Some species are quite outstanding in their development and already give promise as suitable for forest planting.

Experimental plantings, mostly of species that require a more mild climate than that of Wind River, have been established at the Cascade Head Experimental Forest (on the Oregon Coast). They now include hybrid poplars, cottonwood, black walnut, myrtle, yellow poplar, redwood, Port Orford cedar, Sitka spruce, cryptomeria, Chilean cedar, sawara cypress, and cascara. The latter has been planted in pure stands and also in mixture with conifers.

The reforestation of brush areas always presents the problem of high clearing costs or the probability of failure. During the past year an effort was made to work out a method of planting that would partially reduce both cost of planting and probability of failure. Two 1-acre plots were established upon which, in 12' x 12' clearings at staggered intervals several trees were planted, using hemlock in the heaviest shade and Douglas fir elsewhere. Advantage was taken of natural openings when they occurred.

The plantations of ten regional strains of ponderosa pine trees have now passed their tenth year since out planting and were given reexaminations. These six test areas are located in widely different localities--at the Pack Forest of the University of Washington, the McDonald Forest at Oregon State College, at Washington State College, in the Wind River Valley, and at two national forests in eastern Oregon.

Phenological observations which have been recorded from five to ten years on all national forests in Oregon and Washington, and at other stations in the region, were continued during 1937. Reports of cone crops were as heretofore compiled and circulated.

Ponderosa Pine Silviculture

The continuance of studies in the pine region of log, tree and stand quality, and of logging and milling methods and costs, discussed elsewhere in this report, supplemented by the various silvicultural studies under way for several years, have effected notable progress in

an understanding of the economics and silvics of selective cutting. They are the combined outgrowth of our accumulated work in silvics, growth, mortality, forest economics, logging engineering, and utilization. These joint studies are stimulating interest in some form of selection cutting and resulting in the actual adoption in places of the maturity selection system as recommended by the Station.

The year 1937 was outstanding for its several conferences of those interested in pine timberland management. One was held in early October at the Pringle Falls Experimental Forest, attended by about 60 representative lumbermen and foresters. The meeting was sponsored by the Forest Practice Committee of the Western Pine Association to give operators and timberland owners opportunity to see and study the results of seven cutting tests in which over 20,000 trees had been tagged and measured and their value, growth rate, and mortality probability predicted. Comparisons of stumpage realizations from different types of cuts and of growth from corresponding reserve stands were given. From this the visitors learned that on this area on the whole the lighter the cut the better the forestry and the greater the realization per thousand feet. Keen interest was shown in all phases of this demonstration and much favorable comment was given on the importance and significance of the work.

On the Malheur National Forest in June, the Forest Service held a field meet of forest officials from all western regional offices and experiment stations to study and discuss the maturity selection system as there applied largely in accordance with and as a result of the recent studies of this Station.

Routine work in the accumulation of records on ecological and silvicultural plots was continued and occupied a very considerable amount of the time of the one regular man assigned to these studies.

Some tests of burning down snags at Pringle Falls were concluded.

Douglas Fir Silviculture

Studies of environmental factors, life of seed in natural storage, seedling establishment and the like, are being continued at the Wind River Experimental Forest and elsewhere. The fund of information already gleaned from these studies forms the foundation for the broader management studies that are treated in the following paragraphs.

The study of the silviculture of partial cutting in the Douglas fir region now includes 13 permanent sample plots which were put in before logging on areas that were chosen for selective cutting. Some of them have already been logged and reexamined. Also, enough temporary plots were established on other tracts that had in the past received some form of partial cutting to bring the total number of partially logged plots for analysis up to 37. Preliminary analysis shows such a wide variation in logging and windfall loss and condition of reserve stand that

the data lose their significance when averaged, and also that partial cutting, while holding significant possibilities as a silvicultural measure, is by no means applicable to all areas.

An instrumental study of one area where Douglas fir regeneration was well under way under a stand with the crown canopy partially removed indicated that more than half of a full crown canopy must be removed before Douglas fir regeneration will take place.

The Tillamook Burn of 1933, first examined in 1935, was again checked to determine principles of natural regeneration and restocking conditions. In general, the lightly burned, northeastern portion of the burn is well stocked with Douglas fir, hemlock, and cedar seedlings that germinated mostly in the first and second years after the fire. But the heavily burned virgin areas and the areas of old burn and hemlock-looper killing in the southern and western portion of the tract remain poorly stocked. Density of restocking has not increased since 1935 and many of the green trees (single and in groups) that escaped the fire have since died from insect infestation and other causes. Salvage operations that now cover approximately 15 percent of the timbered area burned destroy most of the regeneration and remove most of the remaining green trees that might be a future source of seed but improve conditions for fire control by making the area more accessible and by removing the snags from sizable tracts.

Partial Cutting in Piling-Size Douglas Fir. In anticipation of an opportunity to sell piling in a 90-year-old Douglas fir stand on the Panther Creek Division of the Wind River Experimental Forest an analysis of a considerable area was made to determine the distribution of trees of piling size and quality and what effect their removal would have on the rest of the stand.

The stand improvement study in old-growth Douglas fir, which aims to restore declining stands to a growing condition by the removal of living defective trees, was expanded this year by adding to the 24 cut and girdled plots put in last year 6 one-acre plots upon which poisoning was tried as a means of killing undesirable trees. Sodium arsenite solution was injected into the base of the tree through openings made by boring or with a poisoning tool. Initial results with western hemlock and silver fir indicate that poisoning is less expensive than girdling or cutting and kills the trees more quickly. The study is being conducted in a decadent Douglas fir-hemlock-balsam fir stand on the Wind River Experimental Forest.

Stand improvement plots in alder, established at Cascade Head Experimental Forest, mark the beginning of silvicultural studies with this, our most important broadleaf species, which promises to have large economic importance in forest management. This project now includes thinning, pruning, releasing reproduction, and growth studies on a total of 8 plots.

Slash Disposal in the Douglas Fir Region. A study of slash disposal on clear-cut areas, begun in 1927 by the establishment of sample plots which have been under observation ever since, has been brought to the report stage. The accumulated results of this and allied studies have been assembled and analyzed and a paper by Messrs. Matthews and Munger has been prepared for publication. The purpose of this report is to treat broadly the whole subject of clear-cut land management, not slash disposal alone, and to present scientifically from new data the factors favorable and unfavorable to slash burning considered from the point of view of permanent timberland management.

Fire Studies

Fire Control Planning. Early in the year the Forest Service announced that a comprehensive program of replanning fire control activities on the national forests would be undertaken for completion by 1940. This would include a critical review of all prevention, presuppression, suppression, and personnel management and training techniques and policies with the aim of securing proper emphasis and balance in the development of all fire control activities and a sound measure of financial needs to be used as the basis of the allotment of funds. Fire control research has much to contribute to this project and the fire studies program of the Station has been reoriented in order to focus time and effort upon researches that will contribute directly to the successful completion of the fire control planning job in Region 6. Certain phases of the work have been directly assigned to this Station and three Junior Foresters from the Regional Forester's office are now working on the project under the supervision of the Station staff.

Inventories of forest fire fuels, in the form of "fuel type maps" are basic to fire control planning on each unit of area to be protected. These maps show by colors for each area of a different type, the rate at which a small fire would spread under weather conditions favorable for forest fires and also the rate at which fire line could be constructed. Material assistance was given by the Station in writing instructions and specifications, getting together photographs of fuel types and in instructing mappers for fuel type mapping in the region.

Fire danger rating is an essential part of the fire control planning program. Studies that have been under way for a number of years on fire weather, fuel moisture indicators, low-cost instruments, fire danger stations, visibility measurements, and fire danger rating schemes, and the judgment and experience of research and administrative men were all drawn upon to produce the fire danger rating system now used in Region 6. The fire danger board (see front cover) is the central feature of this system. The boards are 18 by 24 inches in size, and one board hangs in a conspicuous place in each district ranger's office. By means of colored dials the current condition of each factor of fire danger--fuel moisture content, relative humidity, wind velocity, herbaceous stage, visibility and inception danger (risk)--reported by the several fire danger stations in the district are shown in a striking manner. All these

factors are combined by means of simple integration tables to produce one of seven class-of-day ratings, also shown by number and color in a large dial at the top of the board. These class-of-day ratings indicate the fire preparedness and organization necessary according to the district rangers' fire plan.

The supervisor has a board which shows the class of day on each ranger district of his forest. In the Regional Office in Portland is a master board showing, by means of colored lights on a map of the region, the class of day on each ranger district throughout the region.

Production of the fire danger board is an outstanding example of a successful cooperative project between research and administration. This work has been headed by one man paid in part by the Regional Forester's office. Through close cooperation a system was produced which was accepted and used by the field men. The fire danger board has stirred up interest wherever it has been shown.

Other Activities. Studies of going fires were made during the year. These resulted in adding to our "stock in trade" case histories, notes on behavior and control activities, and many photographs. Other activities included some attention to the possibilities of initiating a study of fire effects in southwest Oregon, where there is a very active interest in light burning for grazing. Also, some work was done in perfecting the low-cost weather instruments used at the fire danger stations. Owing largely to the pioneering which this Station has done in developing these instruments and demonstrating the demand for them, several manufacturers are now producing inexpensive equipment on a commercial basis; there is no present need, therefore, for the Station to do further development work.

Forest Mensuration

Sitka Spruce-Western Hemlock Yield Study. The year witnessed the publication and distribution of U.S.D.A. Technical Bulletin No. 544, "Yield of Even-Aged Stands of Sitka Spruce and Western Hemlock" as the culmination of the range-wide yield study of this type by Dr. Meyer. The bulletin has been particularly well received and has focused wide attention upon the remarkable possibilities of the fog belt forests.

A supplement to this bulletin, giving yield tables for trees 6.6 inches and more in diameter, was prepared and distributed in mimeograph form. This is the standard of utilization assumed for many of the yield tables for forest types in other regions of the United States where close utilization is practical at the present time.

Even-Aged Ponderosa Pine Yield Study. After further checking and revision the manuscript resulting from this interregional study is ready for printing as a technical bulletin. Manuscript copies have been sent to each of the western Forest Experiment Stations, and in Regions 1 and 6 the findings of this study are now being used on the growth phase of the forest survey in advance of formal publication.

Growth Phase of Forest Survey, Douglas Fir Region. The growth chapter for the final report on the forest survey of the Douglas fir region was prepared. As a phase of this, site areas were compiled and potential growth computed on the national forest land of the Douglas fir region. The results, summarized in Forest Research Notes No. 23, emphasize the relative importance of national forest and other land from the standpoint of timber productive capacity. National forests contain almost one-third of the region's commercial coniferous forest land but less than one-quarter of its total timber productive capacity.

Growth Phase of Forest Survey, Ponderosa Pine Region. When completed, this project will provide estimates of current, periodic, and potential growth for all the forest land of eastern Oregon and eastern Washington. Basic computations on the 247 growth samples from virgin stands in eastern Oregon and eastern Washington were completed this year and preliminary alignment charts for estimating gross board-foot growth in the virgin ponderosa pine, pure ponderosa pine, pine mixture, and ponderosa pine woodland types were constructed. Knowing volume per acre, site index, and stand structure, the gross increment of the type may be computed from these charts.

The field work of the application of the Douglas fir and the new ponderosa pine yield table to east-side, even-aged stands, initiated near the end of the 1936 season, was finished in 1937. Computations have been completed and the stocking classes of immature stands, as recorded by survey type mappers, were correlated with normal yield table stocking for the purpose of growth prediction.

Application of growth data to east-side forest survey inventory statistics leading to the computation of net increment in the immature types was initiated and is approximately three-fourths finished.

Cubic-foot volume estimates for the forest survey of eastern Oregon and eastern Washington have been carried to about 80 percent of completion.

Growth of Douglas Fir in Even-Aged Stands. Periodic remeasurements were made on 10 of our 38 permanent even-aged Douglas fir growth sample plots, and reports were completed on recent remeasurements of 21 of these plots.

An analysis of the variation in site index between remeasurements for sample plots revealed that the changes are not larger than may be accounted for by the fluctuation of sampling. Hence, there is no evidence in the data analyzed that sample plot tree heights have in the past quarter-century departed significantly from the height-age-site-curve values of the Douglas fir yield bulletin.

Growth in Partially Cut Stands, Douglas Fir Region. Volume and growth computations on the 40 large sample plots in partially cut stands of the Douglas fir region were completed, and the 1937 examinations for mortality following logging were made.

Douglas Fir Thinning Study. The prospects seem bright that the day will come when artificial pruning will be economically practical, and hence it is high time to start finding out the technique of pruning to get best results in our types. Therefore in 1937 four new thinning and pruning study plots were established in the immature, even-aged Douglas fir type on the Olympic National Forest. Parts of two previously established plots, through which a road had been built, were salvaged for future remeasurements. A new pruning experiment designed to test the effect upon growth of removing portions of the live crown was established on the Wind River Experimental Forest. Three degrees of crown removal were used on dominant and co-dominant crop trees.

DIVISION OF RANGE STUDIES

Cooperative Western Range Survey. Much of the time of the range-studies division was taken by the Western Range Survey, a cooperative project between the governmental agencies interested in range management, wherein all range surveys completed by the individual agencies are being combined into reports and maps which will be usable by all. Participating agencies include the Forest Service, the Soil Conservation Service, the Farm Security Administration, the Division of Grazing of the Department of the Interior, the Indian Service, the Agricultural Adjustment Administration, and the Oregon and Washington State Agricultural Experiment Stations. The Division of Research of the Forest Service is acting as the coordinating agency, compiling and checking the field data and drafting the final maps and county reports. The range-survey project is not a permanent activity of the agencies participating, and at present provisions are for its termination on March 1, 1938.

To date 5,068,000 acres of range land in Oregon and 7,666,000 acres in Washington have been covered by range surveys. Of this, 5,180,000 acres were compiled and 1,319,000 acres were mapped to the standard form approved for the Western Range Survey. These latter figures included 733,162 acres in Morrow County, Oregon, and 987,368 acres in Kittitas County, Washington, the counties for which final reports are being written. In addition, 92,000 acres in Kittitas County were surveyed by a crew financed from Western Range Survey funds.

One man from this Station spent most of three months checking in the field the survey crews of the participating agencies in order that all surveys would be uniform.

Methods Used in Range Studies. A study of some methods used in range-forage and range-utilization investigations was made on the alpine grassland-weed range on the Crawfish allotment in the Whitman National Forest. The Eastern Oregon Branch of the Agricultural Experiment Station at Union, Oregon, furnished the sheep used in the experiment. Subjects studied included: (1) Number of plots required to determine the grazing capacity of the type studied on areas of certain sizes, employing the square-foot-density method of sampling; (2) number of plots required to determine the degree of utilization of the type after grazing by sheep, using the ocular-by-plot method; (3) possible relationships between the use of particular species and the utilization of the entire area; (4) variation of individuals in estimating the amount of forage on a given area by the square-foot density and weight-estimate methods; (5) variation of individuals in estimating, by the ocular-by-plot method, the percent utilization of forage plants after grazing by livestock; and (6) the palatability of alpine forage species to sheep. The study is to test these methods and in addition to determine their adaptability for use in studying range-management and range-utilization practices on the open range.

Five hundred plants of mountain bunchgrass (Festuca viridula) were clipped to determine if it is possible to arrive at a mechanical method to determine percent utilization of that important species on summer ranges.

Plant Succession Under Grazing Use on a Douglas Fir Cut-Over Area. Analysis of plots established in 1925 to study plant succession and tree reproduction under different conditions of slash burning and grazing has been completed. Forest-regeneration phases of the study have been previously written up; a paper has now been completed showing trends in plant succession. Weeds, principally fireweed, formed approximately 50 percent of the total plant cover in 1925, one to five years after the area was last burned. After two years of grazing the weeds were reduced until they made up less than 10 percent of all vegetation. Although the fire hazard was lowered temporarily by currently grazing the weeds, the rapid encroachment by bracken on the reburned areas and on the areas on which slash burning had been delayed resulted in a fuel type equally as inflammable as that at the start of the experiment. The duration of grazing on cut-over Douglas fir lands as treated in the experiment is approximately 11 to 15 years, with ample forage in the first 3 to 7 years and a dwindling supply thereafter.

Forage Type Sampling. Sampling of forage types on national forests in Region 6 was started, 43 sample transects being taken on lower ranges of the Umatilla, Malheur, Whitman, Wallowa, Ochoco, and Deschutes National Forests. This work will continue at intervals until all the main types in the region are sampled in order to obtain a knowledge of range conditions in Oregon and Washington, including main species, species mixtures, and relative forage values.

Forest Service Herbarium. The local Forest Service range plant herbarium has been brought up to date. Distribution cards and standard symbols for each species have been made for each plant in the collection.

DIVISION OF FOREST PRODUCTS

Ponderosa Pine Mill Production Studies. Mill production analyses in the ponderosa pine region of Oregon, resumed in 1935, continued to occupy the larger part of the time and funds of the Division of Forest Products. Field work was completed on two cooperative studies in Bend, Oregon. At Brooks-Scanlon Lumber Co. 850 logs were analyzed, coincident with a cutting test conducted by the company, the woods marking of which was done by the Section of Logging Economics. The preliminary results were used by the company in deciding to proceed under a lighter selection system. At the Shevlin-Hixon Lumber Co. 1,200 logs were analyzed; the results will be used in establishing the choice of trees to be removed and left on the company's holdings. Many of these logs came from the experimental cuttings on the Pringle Falls Experimental Forest, and provided a check between woods grading and mill deck grading.

A revision of pond recovery values for the Kinzua study of 1936 was made, based upon costs and selling prices in effect as of November 1, 1937. A new method of adjustment, dependent upon index prices, was tested and found to be both accurate and time-saving. The reports for this and for the Ewauna Box Co. study conducted the same year are nearing completion.

A detailed time study on 4,000 ponderosa pine logs was conducted at a Bend mill, designed to show the production time for logs of different lengths.

Progress has been made on the correlation of the data from the five mills studied since 1935, and with promising results. There is every evidence of so little variation between the mills that type curves for cost and recovery values can be prepared. Should this be the case, we will have a reference standard of such reliability that analyses of other operations can be made with a minimum of field work.

Douglas Fir Mill Production Studies. These studies were continued with sawing time analyses in five mills ranging from 15 M to 40 M in capacity. Time has not yet permitted analysis of these or of grade recovery data obtained in previous years.

Data on grade recoveries in second-growth Douglas fir logs were furnished the Regional Forester's office for use in determining stand values.

Statistical Studies. The gathering and compiling of annual production, distribution, and price data for various forest products has continued as one of our major projects. The lumber, lath, shingle and log production and lumber distribution census for 1936, in cooperation with the Bureau of the Census, was completed in June. The 1936 lumber cut of Oregon and Washington amounted to 8,649,821 M feet, exceeding that of 1935 by 2,052,057 M feet and forming 35.5 percent of the national production.

Lumber, lath, and shingle production in Oregon and Washington since 1869 has been assembled and prepared for distribution. This brings together all available production statistics in as detailed a form as we are permitted to release them.

At the request of the Regional Forester's office tables were prepared showing the cost of Douglas fir lumber production and the selling prices of representative lumber items since the early 1900's. Attempts will be made to fill in certain gaps before publication.

Minor Species Studies. Although occurring only in comparatively small quantities the hardwoods of the Pacific Northwest are of considerable importance to certain of our industries. Studies dealing with properties and uses of red alder, bigleaf maple, Oregon white oak and northern black cottonwood have been completed and the results published. Additional data are being accumulated on other species, particularly Oregon ash.

Miscellaneous Studies. The national forests of Region 6 have installed many miles of telephone line, the poles of which are treated with Anaconda paste. During the year 11 lines so distributed as to cover the various species used and the climatic and soil conditions encountered in the region were established as experimental lines. A hundred poles in each of the lines were numbered, labeled, and completely described. These will be examined and reported upon biennially until sufficient information has been obtained to permit conclusions as to the effectiveness of the treatment and the factors influencing the effectiveness.

For use in connection with the forest survey of the Douglas fir and pine regions, field work was completed on the timber requirements for farm building and for other uses of wood on Oregon farms of different types. The data are partially assembled and should be ready for publication during 1938. The field work was done by the professor of farm management of Oregon State College, giving us the benefit of his wide personal experience with farm conditions. Log depletion data for eastern Washington and eastern Oregon by counties and by years from 1925 to 1936 were compiled for use in the Forest Survey. The 1925-29 depletion data for the western part of the two States were segregated into depletion by years. Cooperation was extended the Portland Park Bureau in relabeling the wood exhibits in the Lewis & Clark Fair Forestry Building.

DIVISION OF FOREST ECONOMICS

Logging Economics

Selective Timber Management in Ponderosa Pine. Several case studies commenced in 1935 and 1936 were carried forward in 1937. Of outstanding importance were the results obtained in a large scale experimental cutting covering approximately 10,000 acres, carried on by the Regional Forester's office as a part of a timber sale to the Edward Hines Lumber Co. This cutting was undertaken to test the light maturity selection system of cutting which was evolved as the result of the "Hines Study" of 1936. In this cutting about 40 percent by volume, comprising the most overmature and generally high-value trees, was removed. Tallies were made of "cut" and "leave" trees, by tree class, log grade, etc. The logs were run through the mill,as a part of a study by the Division of Forest Products mentioned earlier, where every tenth log was graded and where a complete record of lumber grade recovery was obtained over a period of several months. So closely did the results check out with the predictions made in the original study, and so convincing a demonstration of the economic and silvicultural advantages of light cutting was obtained, that this large operation has since remained on a 40 percent cut.

Two other comprehensive case studies, patterned after the Hines study, were virtually completed during the year and are now in the stage of final report writing. One of these covers the operations of the Ewauna Lumber & Box Co. and the other those of the Kinzua Pine Mills, Inc. At both operations detailed mill production studies were made by the Division of Forest Products and comprehensive logging cost and stand structure studies by this Section. In both cases the results of the studies point to the same general conclusion as in the Hines study, viz., that light cutting will lead to important financial and silvicultural gains.

A 120-acre demonstration marking of a 50 percent maturity selection cut was made on the operations of the Brooks-Scanlon Lumber Company at Bend. The marked trees were logged and run through the mill and a record of lumber grade recovery made by the company. In conjunction with this the Division of Forest Products made a detailed analysis of 850 logs. Next the reserve stand was logged and run through the mill in a similar manner, thus affording a direct and simple mass test of comparative lumber grade recovery, and milling and logging costs. Despite the fact that the original stand was of relatively low quality and that a rather large percentage of the best overmature trees had been killed by beetles, the result showed a very distinct gain in value and reduction in cost for the first cut.

A similar demonstration marking followed by similar mass tests of the first and second cuts was made on a 400-acre area on the operations

of the J. Neils Lumber Co., in Klickitat County, Washington. Here, too, substantial gains in value and reduction of costs were shown for the first cut.

The culmination of this widespread interest of ponderosa pine operations in both the economic and silvicultural aspects of light selection came with the demonstration field meet in October at the Pringle Falls Experimental Forest, which has been mentioned earlier in this report.

Selective Timber Management in Douglas Fir. In cooperation with the Division of Silvics and the Regional Forester's office a 280-acre area on the operation of the West Fork Logging Company was marked for selective cutting, but owing to change of logging plans will not be cut until next summer. This company is doing important pioneering work in developing selective methods of logging in the Douglas fir-hemlock type. Of particular interest is their experimental work in adapting donkey logging to individual tree selection on rough and steep ground.

Forest Land Economics

New Public Domain - Western Oregon and Washington. The study of economic factors and relationships which affect the trends in reversion of forest lands to public ownership usually for unpaid taxes, the desirability of using these lands for forest purposes, and the desirable line between private and public ownership has been confined to completing field studies and undertaking the writing of the report on the general phases, and to the technical service usually incident to studies of this nature.

A very large proportion of the tax-forfeited forest lands in Washington reported in this study have been conveyed by the counties to the State, becoming a part of the State forest lands. In taking over these lands State officials have followed the cautious and democratic procedure of first classifying the land, then conferring with county officials, and in doubtful cases conferring with local groups.

Although the counties of Oregon may turn their tax-forfeited forest lands over to the State and the State may accept them as State forests, no conveyances have been effected.

Principles which might be incorporated in sound laws affecting tax-delinquent and forfeited lands were developed by the New Public Domain study and incorporated in two measures submitted to the 1937 Oregon Legislative Assembly. One required prompt foreclosure at the end of three years of tax delinquency, allowed owners one year thereafter in which to redeem their property, and when not so redeemed made title absolute in the counties. This measure became law; if enforced it will terminate more regularly and promptly the indefinite ownership status of tax-delinquent lands, at the same time allowing the owner approximately four years from date of first delinquency in which to pay his delinquent taxes. The other

provided that the State take over all tax-reverted lands, settle the tax equities of local governments in them, classify the lands as to most desirable ownership and use, and dispose of them accordingly; this measure did not become law.

Taxation. Lack of economy in local government, improper administration of the property tax, and failure to adjust property-tax laws to the deferred income nature of forest properties were shown by the Forest Taxation Inquiry to be the principal tax obstacles to private ownership of forest lands. As a follow-up of these studies special consideration was given to the problem of relieving the absolute burden of taxation through the reorganization and disorganization of local government in sparsely settled areas. Studies have been conducted in Skamania, Pacific, and Clallam Counties, Washington, and other representative counties will be covered later.

In both States the drawing and redrawing of special taxing district boundaries has the effect of allotting all private timber values to the support of the several districts. Arbitrary school district boundaries, drawn without reference to school attendance or district served or without any system for the equitable distribution of the available tax base, have encouraged local extravagance in some districts, and in some others have resulted in inadequate school support and very high taxes to preserve the districts' existence. This, together with the annual fluctuations in tax rates common to a narrow tax base, has created uncertainties constituting a great hazard to long-term forest ownership. To remedy this situation a local adaption of a plan that has been in effect in the State of Maine for more than 100 years has been suggested. This plan involves creation of an unorganized territory outside the zone of local governmental influence and creation of a State joint school district coextensive therewith, both under State administration, subjecting the property within to the usual tax for State purposes and a tax at a uniform rate for county and school purposes, but freeing it from all special district levies, and equitably distributing tax moneys from this territory to the counties and school districts of the State.

The New Public Domain Study, and before it the Forest Taxation Inquiry, disclosed many intra- and inter-county inequities and irregularities in the assessed valuation of forest properties traceable primarily to the lack of standard practice and knowledge of the highly technical job of forest valuation on the part of local assessors. This led to the strong recommendation that the authority and responsibility in determining taxable forest valuations be lodged with the State tax commissions, that the valuations so determined be apportioned by the Commission each year to the respective counties in which such lands are situated, and that taxes be levied and collected in the counties on the valuation so apportioned. After prolonged deliberation by the Special Committee on Timber Taxation appointed by the Governor, upon which the Station was represented, these principles were incorporated in a measure which was submitted to the Oregon Legislative Assembly but the measure did not pass.

Land Classification and Planning Activities. This section of land economics continued its cooperation in the detailed economic land surveys in Washington under the direction of Washington State College, and assisted the Farm Security Administration with generalized and preliminary land classification work in Coos and Tillamook Counties, Oregon. The activities of the regional, State, and county planning boards through the first half of 1937 continued to throw a very heavy load upon this section.

Forest Survey

Forest Survey activities during 1937 were concentrated in three fields: (1) The completion of the basic inventory, depletion, and growth computations and publication of inventory statistics and type maps for eastern Oregon and eastern Washington; (2) the completion of the Douglas fir regional report; and (3) the initiation of the inventory revision in western Oregon and western Washington counties.

Computations of type and volume data for the east side counties were completed during 1937 and county statistics and 1-inch-to-the-mile type maps published for all counties which had not been covered by previous publications. These consisted of county statistics for 10 counties and 1-inch-to-the-mile type maps for 4 counties. The $\frac{1}{4}$-inch-to-the-mile lithographed type maps for southeastern Oregon and northeastern Washington were published and distributed during the year, completing the series with the exception of northeastern Oregon. All drafting and preparation of the coloring out sheets for the lithographed type map of northeastern Oregon were completed during the year and the map is now being prepared for printing in Washington.

Preliminary computations on the depletion phase for the east side were completed. Substantial progress was made in computing forest growth, as discussed under the Mensuration section of this report; this phase will be completed early in the spring of 1938. With the completion of the inventory statistics for the east side, it was possible to publish complete forest survey statistics for the national forests of Region 6. Tables giving State inventory totals for the east side have been compiled and will be published in mimeographed form soon after the first of the year.

The manuscript of the Douglas fir regional report was completed late in 1937 and reviewed by members of the Regional Office and the Station. Several conferences were held to discuss a number of points. At the end of the year the report was being prepared for transmittal to Washington for final approval prior to publication.

In order to gain field experience and test working plans for the inventory revision, 2 west side counties were resurveyed. This work consisted of actually remapping and determining forest conditions on

areas that had changed due to cutting or fire since the date of the original field work, which began in 1930. Areas cut over between 1920 and 1930, originally mapped as recent cut-over land without any classification as to restocking, were examined during the field season to determine status of restocking. Areas cut over before 1920 and nonrestocked at the time of the original examination were reexamined. Analysis of these data will indicate the progress of natural reforestation. The original data are not only being revised where needed but constantly strengthened. Collateral information concerning minor forest products is being gathered during the revision process. The counties in which the experimental work was done were Clatsop County, Oregon, and Grays Harbor County, Washington. Results of this field work are now being compiled and new inventory statistics for these counties will be published early in the spring of 1938. On the basis of field experience, plans are being prepared for carrying on this work on a larger scale in 1938.

The distribution of statistical publications and type maps was continued throughout the year at about the same pace as the preceding year. Special requests for both statistical and map data which could not be fulfilled with the regular Forest Survey publications continued to take a large part of the time of the staff.

Forest Survey statistics and maps have been of great value in preparing preliminary flood control reports. Late in the year the Division of State and Private Forestry of the Regional Forester's office completed the compilation of forest inventory data for sustained-yield working circles, 143 in number, set up for the States of Oregon and Washington. This project was based on Forest Survey data and has been carried on for about 2 years.

Forest Fire Insurance

As a follow-up of the publication of the result of the searching study of forest insurance made at the Station during the period 1930 to 1934 (Forest Fire Insurance in the Pacific Coast States, U.S.D.A. Tech. Bul. 551), Mr. Shepard spent two months here in the summer working on the promotional phase of this project in cooperation with the Regional Forester's office. Timber owners, officers of insurance companies, executives of lumbermen and forest fire associations, and the State foresters were contacted to determine their attitude toward forest insurance if a practical offering could be made. The responses were encouraging. Not one of the 25 timber owners interviewed, representing some 2,000,000 acres of land, was unfavorable to a forest insurance undertaking.

FLOOD CONTROL STUDIES

The Flood Control Act of 1936 states that "destructive floods upon the rivers of the United States, upsetting orderly processes and causing loss of life and property, including the erosion of lands, and impairing and obstructing navigation, highways, railroads, and other channels of commerce between the States, constitute a menace to national welfare" . . . and "that, hereafter, Federal investigations and improvements of rivers and other waterways for flood control and allied purposes shall be under the jurisdiction of and shall be prosecuted by the War Department under the direction of the Secretary of War and supervision of the Chief of Engineers, and Federal investigations of watersheds and measures for run-off and waterflow retardation and soil erosion prevention on watersheds shall be under the jurisdiction of and shall be prosecuted by the Department of Agriculture under the direction of the Secretary of Agriculture".

For the purpose of administering this act the Department of Agriculture divided the United States into several territories and designated certain of its officers as members of committees to represent the Department in these territories. The committees were given the task of preparing the preliminary flood control reports which are required for each watershed and which make recommendations as to the need for and scope of detailed surveys of the flood control problem. All of western Oregon and western Washington, and practically all of eastern Washington except the territory drained by the Snake and Walla Walla Rivers, was assigned to Committee No. 22, which is composed of three members, one each from the Bureau of Agricultural Economics, the Soil Conservation Service, and the Pacific Northwest Forest Experiment Station (chairman). Committee No. 21 was assigned the streams in the southeast corner of Washington and practically all of the streams in eastern Oregon, except those draining directly into the Snake and the Klamath Rivers. The membership of Committee No. 21 is the same as of No. 22, except that the Regional Conservator of the Soil Conservation Service is chairman.

Early in the year this Station began work on the new program, with correspondence and interviews with the War Department and informal conferences with representatives of the other bureaus of the Department of Agriculture interested in this work. No funds were allotted for the administration of the act until July 1, but prior to this time members of the Bureau of Agricultural Economics, Soil Conservation Service, and Experiment Station who were assigned to this work had met and discussed the outline for preliminary reports which was sent from Washington, D.C. Assignments of different topics called for in the outline were made to each of the three bureaus and the committee decided that the Lewis River watershed in western Washington would be a good stream on which to start. As soon as funds were received work was started on the first draft of the preliminary report for the Lewis River, and in late August the members of the committee met again and thoroughly reviewed these first drafts. The final report for this watershed was sent to Washington in

November. In the meantime the first drafts of the reports for the Walla Walla and Chehalis Rivers were completed and by the end of the year considerable work had also been done on preliminary drafts for the Skagit and Nooksack watersheds.

The administration of the act involves the holding of public hearings for the various watersheds in order that local people may express their views. These hearings were conducted jointly by representatives of the Departments of War and Agriculture. During the year a total of 17 such joint hearings were conducted for the territory assigned to Committee No. 22. Hearings were held during every month of the year except for the period May to August, and the following streams were involved: Yakima River in eastern Washington; Skagit, Chehalis, Nooksack, Nisqually, Cedar, Sammamish, Snohomish, Stillaguamish, and Duwamish-Green Rivers, and Goldsborough Creek in western Washington; the Willamette, Clatskanie, Chetco, Smith, Alsea, and Nestucca Rivers in western Oregon.

During September and October members of the Station working on flood control studies also spent considerable time in conjunction with members of the Regional Forester's office, the Bureau of Agricultural Economics, and Soil Conservation Service on the revision of the National Resources Committee report "Drainage Basin Problems and Programs".

PUBLICATIONS AND DISSEMINATION OF RESULTS

The following titles of bulletins, articles, and published addresses by members (or former members) of the Station's technical staff, printed or otherwise distributed during 1937, give an idea of the variety of subjects upon which work is being done and the range of activities that are being served. The following lists do not include manuscripts prepared but not yet issued nor office reports on projects which have not yet reached the publication stage.

A large part of the Station service is performed through correspondence, individual and group conferences, and news releases, as well as through formal publications.

Members of the staff gave some dozen formal talks during the year at conventions, forums, etc., not including a number of technical lectures to college and university classes by seven different individuals.

Papers Printed During the Year

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Brandstrom, A. J. F. The role of selective cutting in promoting sustained yield, with special reference to ponderosa pine. Jour. Forestry 35 (2): 142-147, Feb. 1937.

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Meyer, W. H. Yield of even-aged stands of Sitka spruce and western hemlock. U.S. Dept. of Agri. Tech. Bul. 544, March 1937.

Morris, W. G. Fall precipitation comparison. West Coast Lumberman 64 (2): 23, Feb. 1937.

Munger, T. T. Flood control and land management. Pacific Northwest Regional Planning Conference. Proceedings, 4th, 1937, p. 70-72.

_____ Forests of the northwest, as a source of raw material for the nation's industries. Pacific Northwest Chemurgic Conference, August 1937, p. 20-22.

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_____ Forest type map, State of Washington. (Northeast quarter) 1937.

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Wilson, S. A. Land resources. Pacific Northwest Regional Planning Conference. Proceedings, 4th, 1937, p. 43.

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Cowlin, R. W., Moravets, F. L., & Forest Survey Staff. Timber volume and type acreage on the national forests of the North Pacific region. Nov. 24, 1937. (Forest Research Notes No. 22).

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Johnson, H. M. Average western wholesale prices per square of western red cedar shingles f.o.b. mill, Oregon, Washington, and British Columbia, 1937.

_____ Average log prices by regions, west side Oregon, Washington, and British Columbia, 1937.

Lodewick, J. E. Log, round timber and burl exports from Oregon in 1936.

_____ Log, round timber and burl exports from Washington in 1936.

_____ Shipments of cascara bark by water from Oregon and Washington, 1936.

Meyer, W. H. Yield tables for trees 6.6 inches and more in diameter in even-aged stands of Sitka spruce and western hemlock. (Supplement to Tech. Bul. 544). Aug. 1937.

Munger, T. T. & Kolbe, E. L. The Wind River arboretum from 1932 to 1937. Oct. 30, 1937.

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White paper from Douglas fir, by J. E. Lodewick.

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Size and volume of ponderosa pine in Klamath, Deschutes, and Lake Counties, Oregon, by F. L. Moravets.

Ten years' growth of Douglas fir spacing-test plantations, by L. A. Isaac.

Temperature and humidity controls in Douglas fir dry kilns, by J. E. Lodewick.

Rating fuel conditions on cut-over lands, by D. N. Matthews.

Summer moisture changes in some dead and live forest fuels, by W. G. Morris.

Diurnal changes in fuel moisture in the Douglas fir forest as affected by cover conditions, by W. G. Morris.

Tax relief through reorganization of local government, by Wade DeVries.

_____ Report for the calendar year 1936. January 19, 1937.

_____ Wind River Experimental Forest, Carson, Washington. 1937.

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Baker County, Oreg., by W. H. Bolles	May 10, 1937
Crook County, Oreg., by H. M. Wolfe	May 25, 1937
Ferry County, Wash., by E. D. Buell	Apr. 15, 1937
Grant County, Oreg., by W. E. Pelto	Aug. 5, 1937
Morrow County, Oreg., by W. E. Sankela	Apr. 30, 1937
Okanogan County, Wash., by P. A. Briegleb	Mar. 25, 1937
Umatilla County, Oreg., by W. E. Sankela	July 5, 1937
Union County, Oreg., by W. V. Litchfield	Aug. 23, 1937
Wallowa County, Oreg., by E. D. Buell	June 25, 1937
Wheeler County, Oreg., by F. L. Moravets	June 10, 1937

Where are the Range Studies Publications??

APPENDIX - LIST OF CURRENT RESEARCH PROJECTS

Following are the file designations and titles of the current research projects approved by the North Pacific Research Committee for the year 1937. This list does not include the projects of cooperating agencies--the Forest Insect Field Station, the Office of Forest Pathology, and the Biological Survey--nor the "administrative studies" conducted by national forest officers.

Many of these projects are broadly worded and very inclusive, and are continued year after year; however, different phases of such projects are taken up successively and concluded.

B-1	Phenology of forest trees and associated vegetation.
Fs	Genetic traits of various strains of Douglas fir and ponderosa pine seed.
Fn	Nursery practice for Pacific Northwest tree species.
Fp	Technique of out-planting--including species, sites, and methods studied, and direct seeding.
Fp Exotics	Adaptability of exotic species to the Pacific Northwest, including maintenance of Wind River Arboretum.
M-1	Silviculture of the Douglas fir region, particularly the silvical and ecological aspects of regeneration, as well as basic silvical study of Douglas fir, spruce, and hemlock.
M-1 Slash Disposal	Slash disposal in the Douglas fir, spruce-hemlock, and Port Orford cedar types.
*M-1 Selective Logging	Silvicultural aspects of selective logging in the Douglas fir region, covering fire protection, growth, regeneration, and related phases. (Formerly a part of project M-1 above.)
M-2	Management and silvics of ponderosa pine, particularly effects of various types of selective cutting.
M-Red Alder	Silviculture and stand improvement of red alder.
Mt-1	Stand improvement in immature and overmature Douglas fir forests.
Mt-2	Stand improvement in ponderosa pine forests.
ME-1	Mensuration of Douglas fir type, including permanent plot studies of growth, yield, volume, and form in even-aged and in partially cut stands.

*New project, or segregated as new project this year.

ME-2	Mensuration of ponderosa pine type, particularly yield of even-aged stands and regional growth of virgin stands.
ME-2 Growth Cycles	Growth cycles in ponderosa pine trees.
ME-3	Mensuration of spruce-hemlock, particularly growth of even-aged stands in the fog belt and permanent plot study of partially cut stands.
*ME-Growth Phase Forest Survey	Growth phase of the forest survey, east side.
Pf-1 Attack	Techniques of fire prevention, detection and suppression, particularly fire-danger rating, visibility studies, manpower production, and the research phases of the national forest fire control replanning project.
Pf-2 Behavior	Factors which influence fire spread and behavior.
Pf-3 Effects	Fire damage, including effect of fire on stands of various kinds.
*RM-1 Fir Region	Range management studies in the Douglas fir region, particularly on logged-off lands.
*RM-2 Pine Region	Range management studies in the ponderosa pine region, including the testing of technical methods.
*RM-3 Western Range Survey	Preparation with cooperating agencies of a complete type map and the inventorying of the vegetative cover and grazing capacity value of all range lands in the Pacific Northwest region.
RP-Milling Studies	Sawmill production studies at large pine and small Douglas fir mills, and survey of dry kiln practice.
RP Woods & Mill Utilization	Investigations of methods for reducing woods and mill waste and bettering utilization practice.
RP-Species Utilization	The economics and utilization of Oregon and Washington minor species and minor forest products.
RP-Properties of Wood	Miscellaneous studies and service tests of the properties, identification, utilization, and durability of local woods.

*New project, or segregated as new project this year.

RE Statistics	Statistical studies of production, distribution, and prices of forest products, including the annual lumber, lath, shingle and log census in cooperation with the U. S. Bureau of the Census.
RE Forest Survey D.F. Region	The forest survey of the Douglas fir region, including preparation of comprehensive regional report and revision of the inventory for certain counties.
RE Forest Survey East Side	The forest survey of eastern Oregon and Washington. (Office work only)
RE-NPD West	Tax delinquency and abandonment of forest lands, western Oregon and Washington.
*RE-NPD East	Tax delinquency and abandonment of forest lands, eastern Oregon and Washington.
*RE-Land Classification	Development of ecological and economic principles for classification of lands in coast counties.
RE Taxation	Contribution the national forests should make to local government in lieu of taxes.
*RE-Taxation Case Studies	Study in sample counties of the relationship of property tax, reorganization of local governments, and finance of local governments to the economics of forest ownership.
RE-NPD Case Studies	Application of land ownership and taxation studies to problems of land classification, rural zoning, and taxation.
RE-Logging Finance-Pine	Financial aspects of forest management and exploitation in the ponderosa pine region.
RE-Logging Finance-Fir	Economic aspects of selective logging in Douglas fir region.
*RE-Log Transport	Motor truck log hauling costs.
*RE-Machinery Design	Design and development of "forestry designed" logging machinery to promote better woods practices.

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